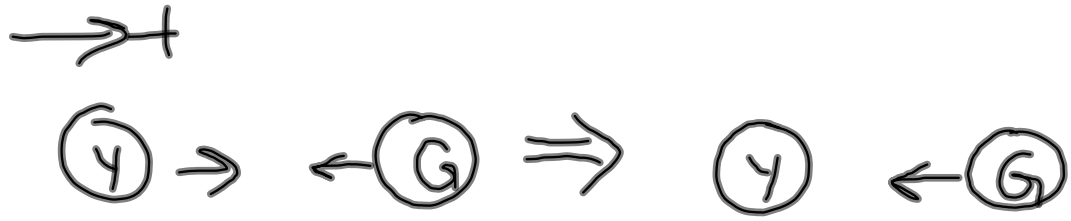
A 1.55 kg yellow sphere moving at 5.55 m/s to the right collides head-on with an 8.55 kg green sphere moving at 5.55 m/s to the left. After the collision, the green sphere is still moving to the left, but now with a speed of 3.25 m/s. What will the yellow sphere's velocity be afterward?



$m_y = 1.55\ kg$ $\quad m_G = 8.55\ kg$

$\bar{v}_{iy} = +5.55\ m/s$ $\quad \bar{v}_{iG} = -5.55\ m/s$

$\bar{v}_{fy} = ?$ $\quad \bar{v}_{fG} = -3.25\ m/s$

$$m_y \bar{v}_{yi} + m_G \bar{v}_{Gi} = m_y \bar{v}_{yf} + m_G \bar{v}_{Gf}$$

$$v_{yf} = \frac{1}{m_y}\left[m_y v_{yi} + m_G v_{Gi} - m_G v_{Gf}\right]$$

$$= -7.14\ m/s$$

HW: p. 142: 56, 57, 58

p. 143: 59

Impulse - Momentum Theorem:

$$\bar{F}\Delta t = \Delta \bar{p}$$

impulse — change in momentum

What is force?

- Something that causes a change in momentum

Expanded Impulse-Momentum:

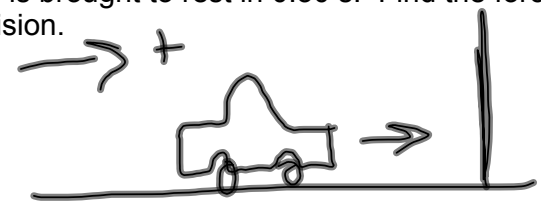
$$F\Delta t = m\Delta \bar{v}$$

$$\bar{F}\Delta t = m(\bar{v}_f - \bar{v}_i)$$

$$\bar{J} = \bar{F}\Delta t$$

impulse

A 1400 kg car moving eastward with a velocity of 15 m/s collides with a utility pole and is brought to rest in 0.30 s. Find the force exerted on the car during the collision.



$m = 1400\ kg \quad \Delta t = 0.3\ s$

$\bar{v}_i = +15\ m/s \quad \bar{v}_f = 0\ m/s$

$$F\Delta t = m(v_f - v_i)$$

$$F = \frac{m(v_f - v_i)}{\Delta t}$$

$$= \frac{(1400\ kg)(0\ m/s - 15\ m/s)}{(.3\ s)}$$

$$= -70000\ N$$

$$\text{Units of Force} = \frac{kg \cdot m}{s^2} = N$$

newtons